



6th NOAA Testbed and Proving Grounds Workshop

JPSS Proving Ground and Risk Reduction Update

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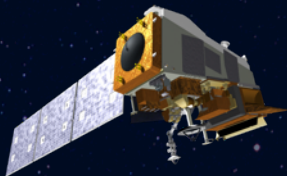
JPSS Program Science Office

14 Apr 2015



Outline of Presentation

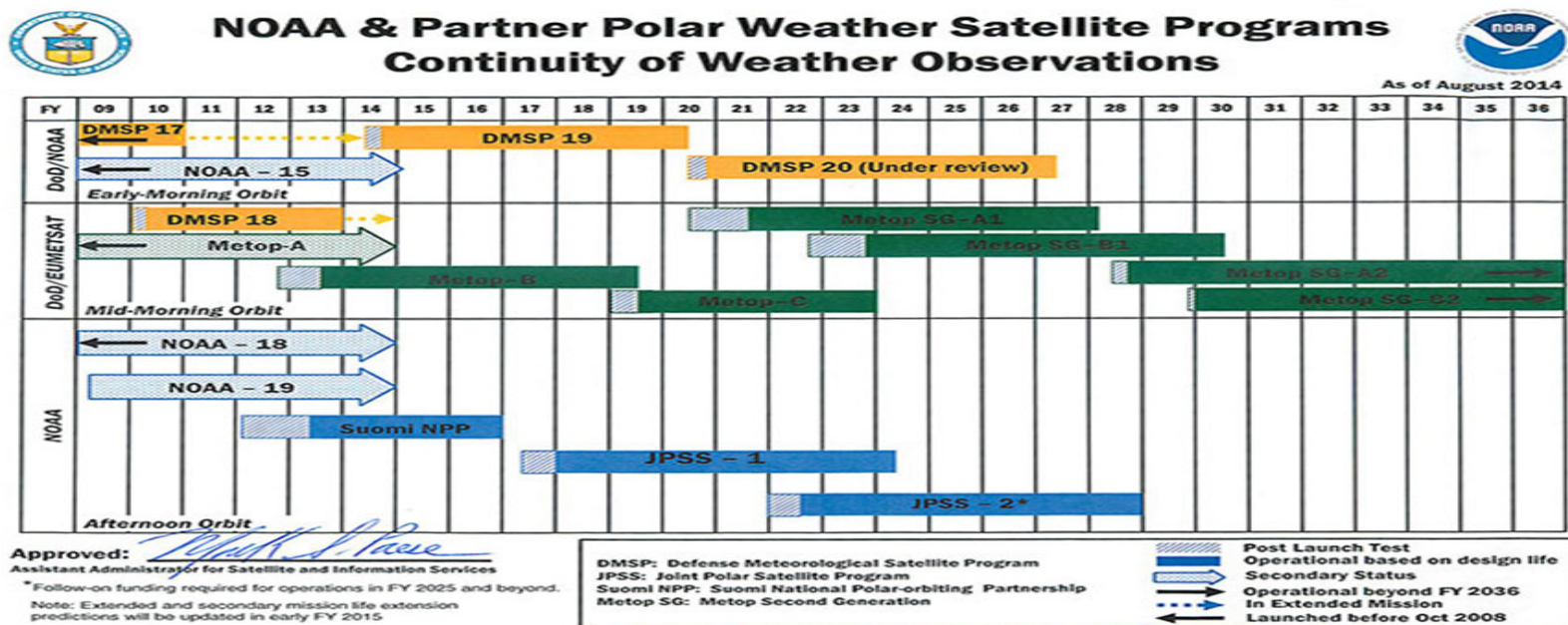
- JPSS Overview
- JPSS Proving Ground and Risk Reduction (PGRR) Background
- JPSS Contributions to NOAA Testbeds
- Specific Testbeds and JPSS Activities
- JPSS PGRR Call for Proposals (FY15-16)
- Conclusions

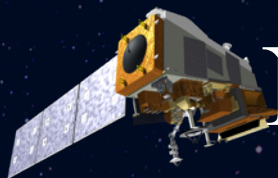


JPSS Overview



- JPSS consists of three satellites (Suomi NPP, JPSS-1, JPSS-2), ground system and operations through 2025
 - SNPP is now NOAA's primary weather polar orbiting satellite providing global data.

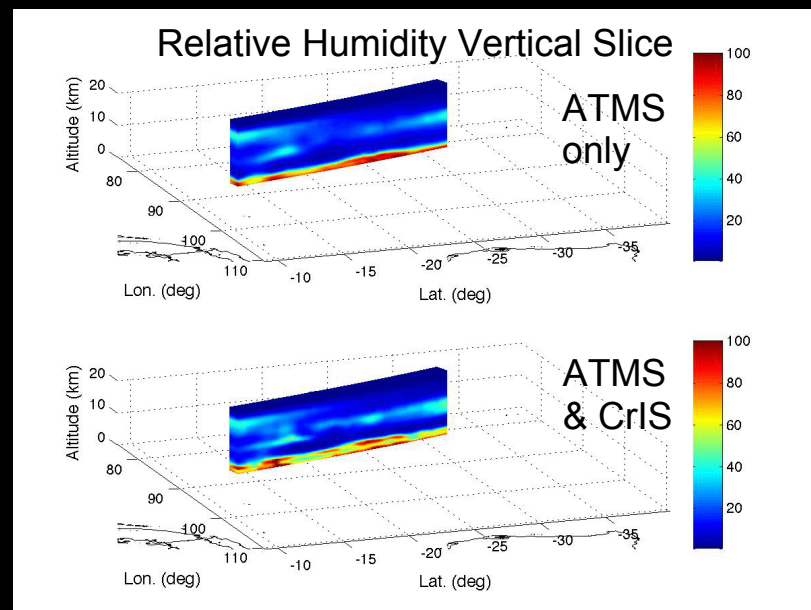




NOAA / NASA Suomi-NPP



- Launched on October 28, 2011, bridge from legacy POES/EOS to JPSS
- 3rd Anniversary On October 28, 2014,
- In three years - 15,550 orbits, more than 31.719 petabytes of data = to 266,076,160 (16GB) smartphones.
- Observations are exceeding expectation with high data availability.
- Named NOAA's primary polar-orbiting weather satellite on May 1, 2014



This animation depicts vertical resolution enhancement by using CrIS with ATMS



JPSS Program Status

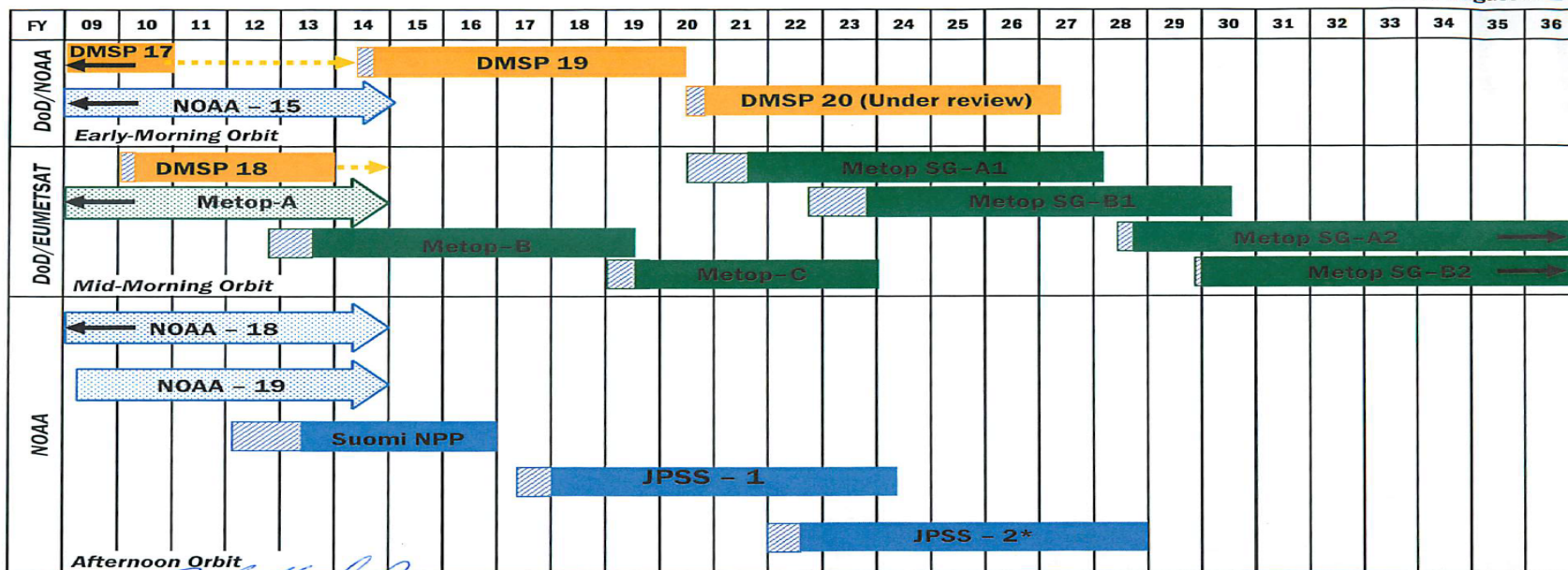
Polar Program Satellite Flyout Chart



NOAA & Partner Polar Weather Satellite Programs Continuity of Weather Observations



As of August 2014








Approved: 
Assistant Administrator for Satellite and Information Services

* Follow-on funding required for operations in FY 2025 and beyond.




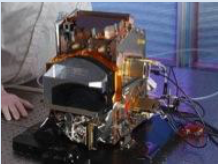

Note: Extended and secondary mission life extension predictions will be updated in early FY 2015

DMSP: Defense Meteorological Satellite Program
JPSS: Joint Polar Satellite Program
Suomi NPP: Suomi National Polar-orbiting Partnership
Metop SG: Metop Second Generation

 Post Launch Test
 Operational based on design life
 Secondary Status
 Operational beyond FY 2036
 In Extended Mission
 Launched before Oct 2008



JPSS Background Sensors

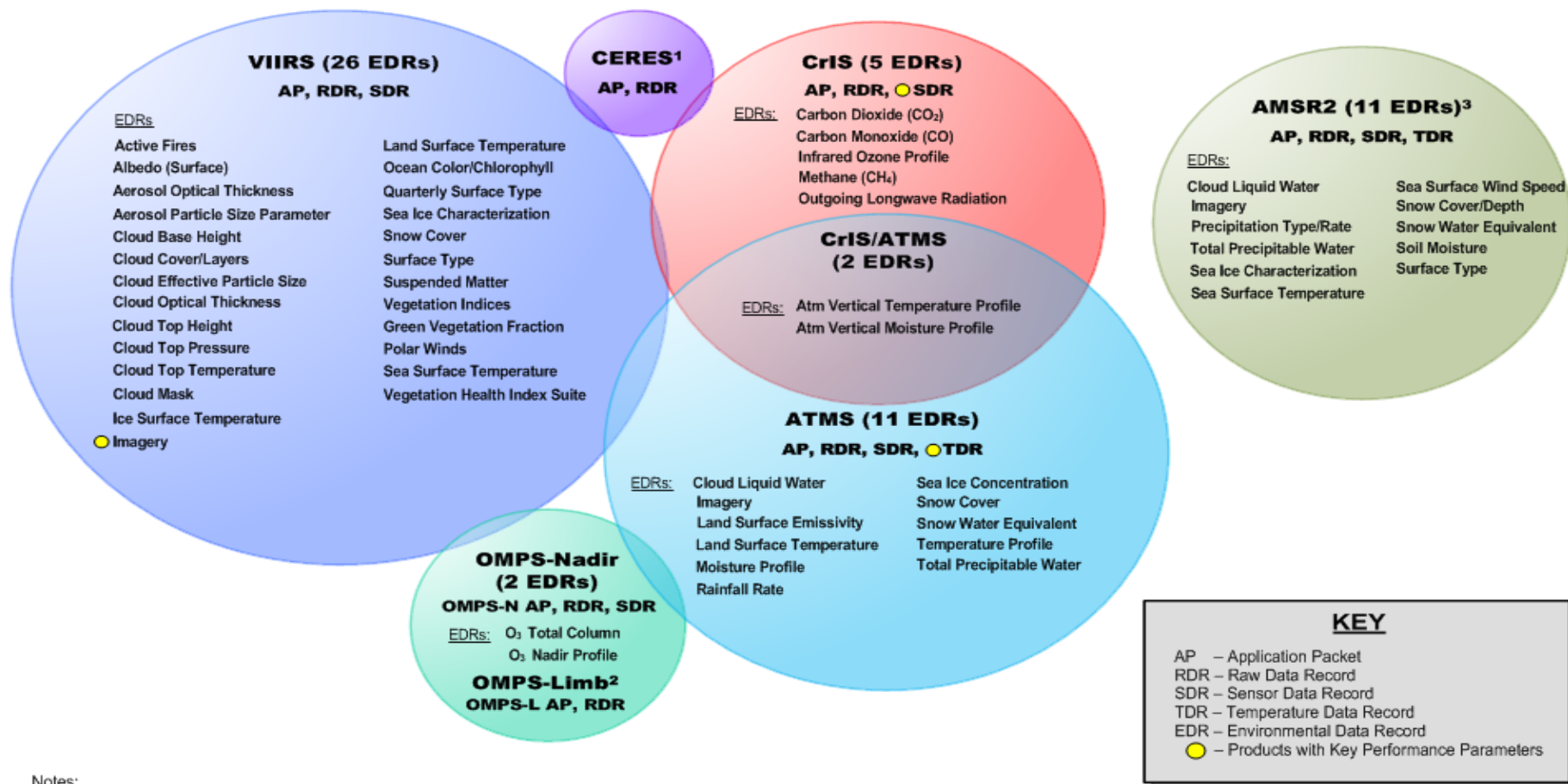
<i>JPSS Instruments</i>		<i>Measurements & Products</i>	<i>Contractor</i>
	ATMS - Advanced Technology Microwave Sounder	High vertical resolution temperature and water vapor information critical for forecasting extreme weather events, 5 to 7 days in advance	Northrup Grumman Electronic Systems
	CrIS - Cross-track Infrared Sounder		Exelis
	VIIRS – Visible Infrared Imaging Radiometer Suite	Critical imagery products, including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton abundance/chlorophyll	Raytheon Space and Airborne Systems
	OMPS - Ozone Mapping and Profiler Suite	Ozone spectrometers for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts	Ball Aerospace and Technologies Corp.
	CERES – Clouds and the Earth's Radiant Energy System (S-NPP and JPSS1) RBI – Radiation Budget Instrument (JPSS-2, 3, 4; provided by NASA)	Scanning radiometer which supports studies of Earth Radiation Budget (ERB)	CERES - Northrup Grumman Aerospace Systems RBI - Exelis



JPSS Background

JPSS Program Data Products

JPSS Level 1 Requirements Document, v1.8



Notes:

¹AP and RDR for the JPSS-2 Mission are contingent on NASA manifest of the Radiation Budget Instrument (RBI)

²Not applicable to JPSS-1; AP and RDR contingent on NASA manifest of OMPS-Limb on the JPSS-2 Mission

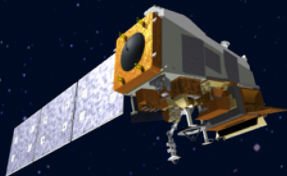
³All products dependent on the Global Change Observation Mission (GCOM) provided by the Japan Aerospace Exploration Agency

The JPSS Program includes Ground System Support for the Metop, DMSP, and GCOM missions

April 3, 2015

This chart is controlled by JPSS
Program Systems Engineering

JPSS-P
Rev C.1

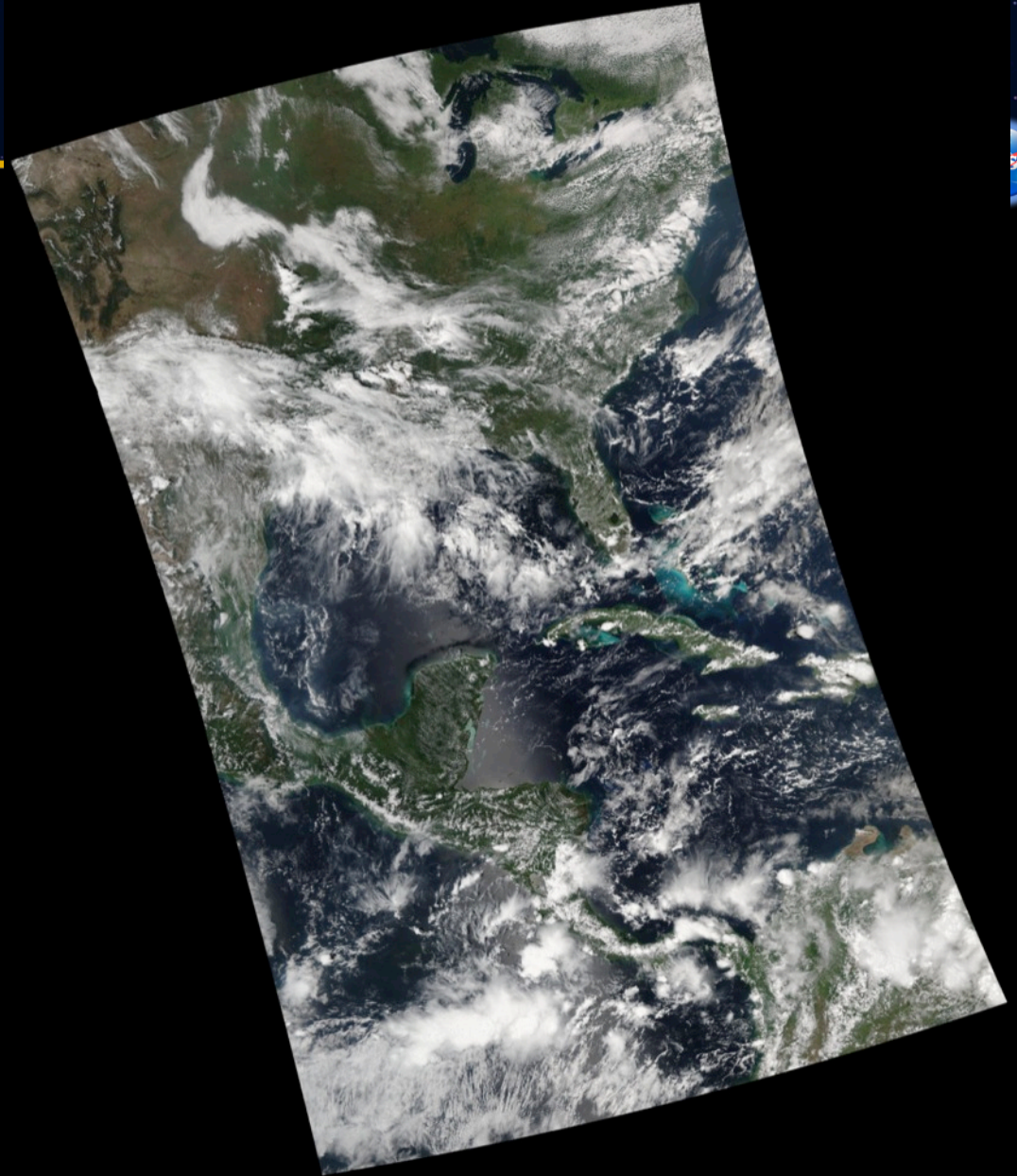


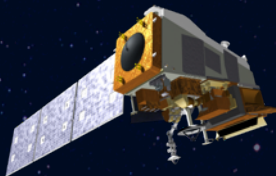
JPSS System Architecture



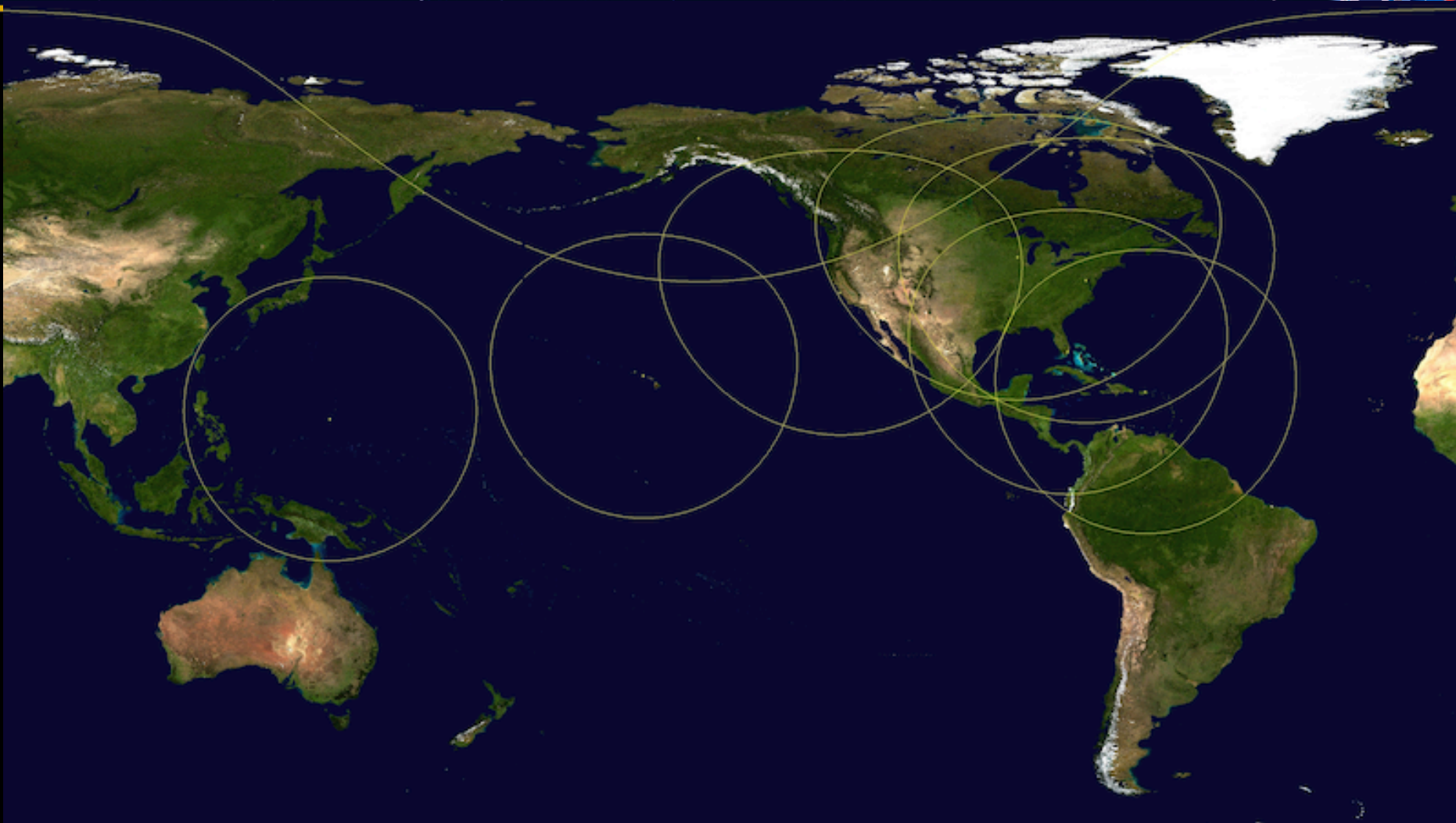


- First VIIRS true color imagery from the new direct readout station at AOML in Miami
- September 18, 2014





NOAA DBRTN Sites (DEMO)





JPSS Background

S-NPP NOAA Operational Customers

NOAA real-time customers of S-NPP/JPSS include:

- ✓ National Weather Service
 - ✓ ATMS and CrIS for weather forecasts
 - ✓ VIIRS nowcasting imagery and products
 - ✓ VIIRS environmental products for modeling, assessments and forecasting
 - ✓ OMPS ozone for ozone monitoring, UV forecasts
- ✓ National Ocean Service
 - ✓ Coastal Water Quality/Harmful Algal Bloom alerts
- ✓ National Marine Fisheries Service
 - ✓ Marine Resources/Ecosystems
- ✓ NOAA Satellite and Information Service
 - ✓ Hazard Mapping System (Fire, Volcanic Ash, Smoke, Precipitation, Oil Spills)
 - ✓ Okeanos/Coastwatch



JPSS PGRR Background Definitions

- **Proving Ground**

- Demonstration and utilization of data products by the end-user operational unit, such as a NWS Weather Forecast Office or Modeling Center.
- Promote outreach and coordination of new products with the end users, incorporating their feedback for product improvements

- **Risk Reduction**

- Development of new research and applications to maximize the benefits of JPSS satellite data
 - Example - use of Day Night Band for improved fog and low visibility products at night, benefiting transportation industry.
- Encourages fusion of data/information from multiple satellite, models and in-situ data
- Primary work is done at the algorithm and application developer's institution.
- Address potential risk in algorithms and data products by testing alternative algorithms.



JPSS PGRR Background

Application Areas

Weather Forecasting - Improving Global, Regional forecasts

Tropical Cyclones

Severe Weather (Nowcasting)

Ocean/Coastal - Coral Bleaching, Harmful Algal Bloom alerts

Land - Droughts, Agriculture

Hazards - Smoke, Fire, Volcanic Ash, Air Quality

Hydrological - Precipitation, Floods, Soil Moisture, Snow/Ice, River Ice

Climate - Integrated products, real-time anomaly products

Education and Training

Infrastructure - Direct Readout + Software (CSPP), Airborne campaigns

JPSS Proving Ground Partners :

NWS, NOS, NMFS, OAR, NESDIS, NOAA Cooperative Institutes, NASA, and NRL



User Feedback is Addressed Through Algorithm Testbed

Operational product is tested by the user with resources provided by Proving Ground if needed.

- If the impact of the operational JPSS product is below expectation then STAR through their algorithm testbed develops an enhancement to the algorithm.
- User demonstrates impact of enhanced product with their current operational baseline.

If demonstration of the enhancement is successful then

- ✓ Enhanced algorithm is promoted to operations
- Else go back to algorithm testbed for further refinements.



PGRR Established to Respond to User Feedback

- First initiative established in response to Galena AK flooding in May 2013
- Initiative teams included River Ice and River Flooding Project teams, direct broadcast SMEs, and River Forecast Center forecasters
- Success of River Ice and Flooding Initiative led to creation of Fire and Smoke Initiative and NUCAPS Initiative
- The continued success of the multi-agency initiative teams further solidified with FY15-16 JPSS PGG Call for Proposals establishing 13 Initiatives
- Initiatives will seek to leverage NOAA Testbed capabilities to maximum extent possible



Testbeds and JPSS Activities

Testbed

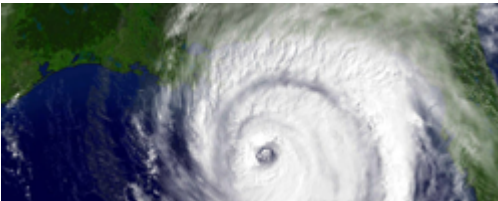
Hydrometeorology Testbed



Hazardous Weather Testbed



Joint Hurricane Testbed



Alaska Aviation Support



JPSS Activities

- **CalWater 2015**
 - Demonstrate the value of real time NUCAPS
 - JPSS DB from Corvallis antenna 5am/5pm passes
 - NUCAPS Soundings validated with dropsondes from WP-3D and G-IV, and radiosonde from NOAA Ship Ron Brown
- **2015 Spring Experiment**
 - Provide NUCAPS Training to NWS participants
 - Evaluate use of NUCAPS Soundings in pre-severe storm environment
- **2015 Summer Plans**
 - Build on success of 2014 Work
 - Use of JPSS DNB to evaluate TC structure
 - Increase operational application of AMSR2 and CrIS/ATMS products
- **Cold Air Aloft**
 - Responded to AK Aviation operational requirement for -65C
 - Evaluated NUCAPS soundings in AK Region
 - Determined best visualization approach



HMT Support



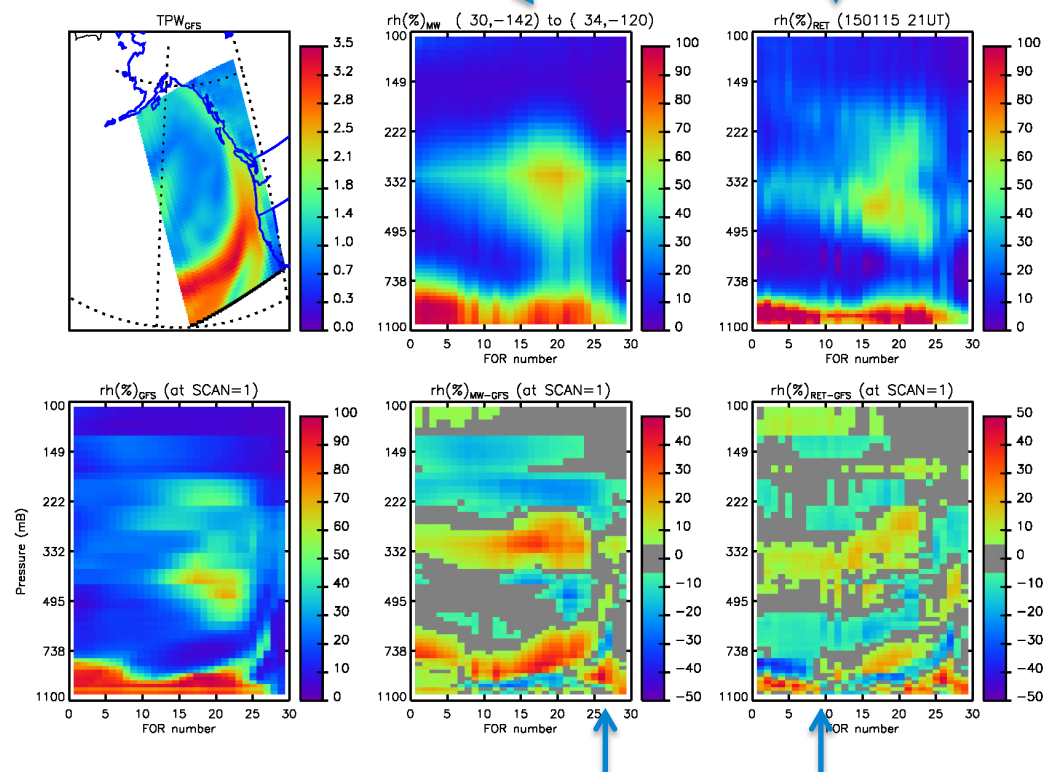
The value of NUCAPS is that it sees the entire domain of the field campaign in one snapshot

NUCAPS Microwave RH Retrieval cross section along scanset indicated on the top left figure. Insensitive to non-precipitating clouds

NUCAPS Microwave + Infrared RH retrieval cross section along same scanset. More sensitive to clouds but higher vertical resolution

- **NUCAPS “scanset” is acquired in 8 seconds**
- **Retrieval spatial resolution is ~50km at nadir; ~70x134 km at edge of scan**
- **In many cases these retrievals reveal structures many hours in advance of a model analysis (i.e., CrIS/ATMS have not been ingested)**
- **Differences shown at right could be due to retrieval errors or GFS errors**

GFS RH cross section (along scanset indicated on top left



NUCAPS Microwave retrieval – GFS

NUCAPS Microwave + Infrared retrieval – GFS



NUCAPS was used to provide Skew-T plots along the flight track while aircraft was in the air

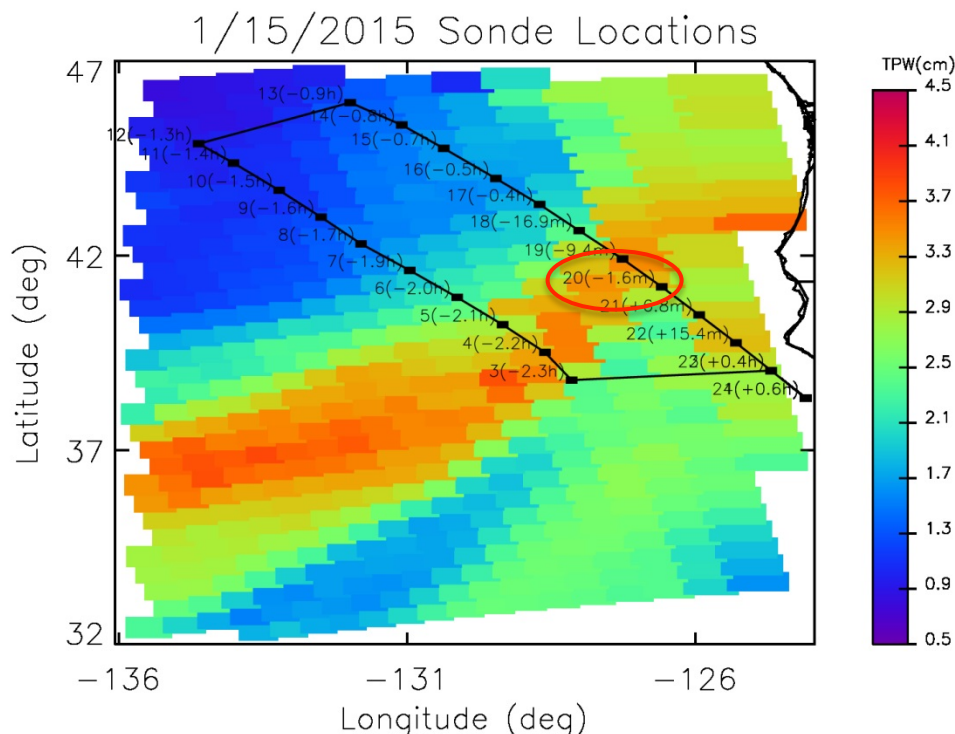
We used CSPP direct broadcast NUCAPS retrievals during CalWater 2015

- ✓ Near real time retrievals (~1 hour latency) from Corvallis direct broadcast antennas were used as guidance for G-IV flight planning during CalWater 2015
- ✓ We are now using the drop sondes measurements collected during the flights to perform post-flight validation tests and assess overall performance (see next slide).

Also used Hawaii direct broadcast to support G-IV flights after Feb. 14th

Key Take Away!

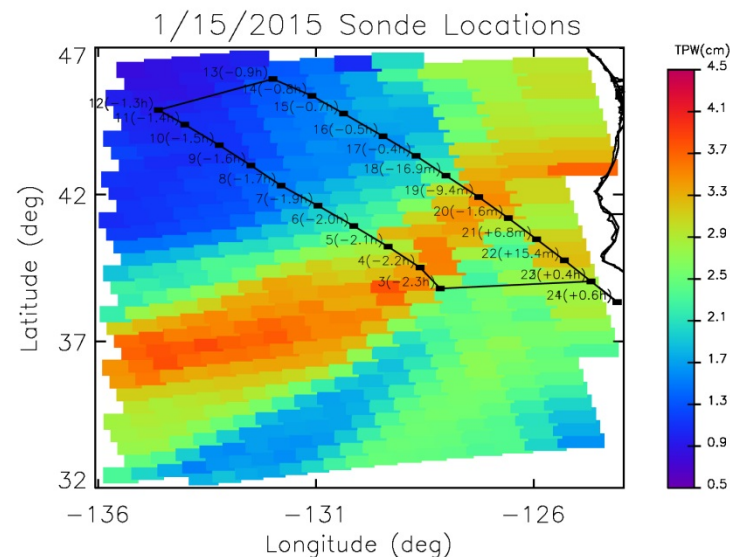
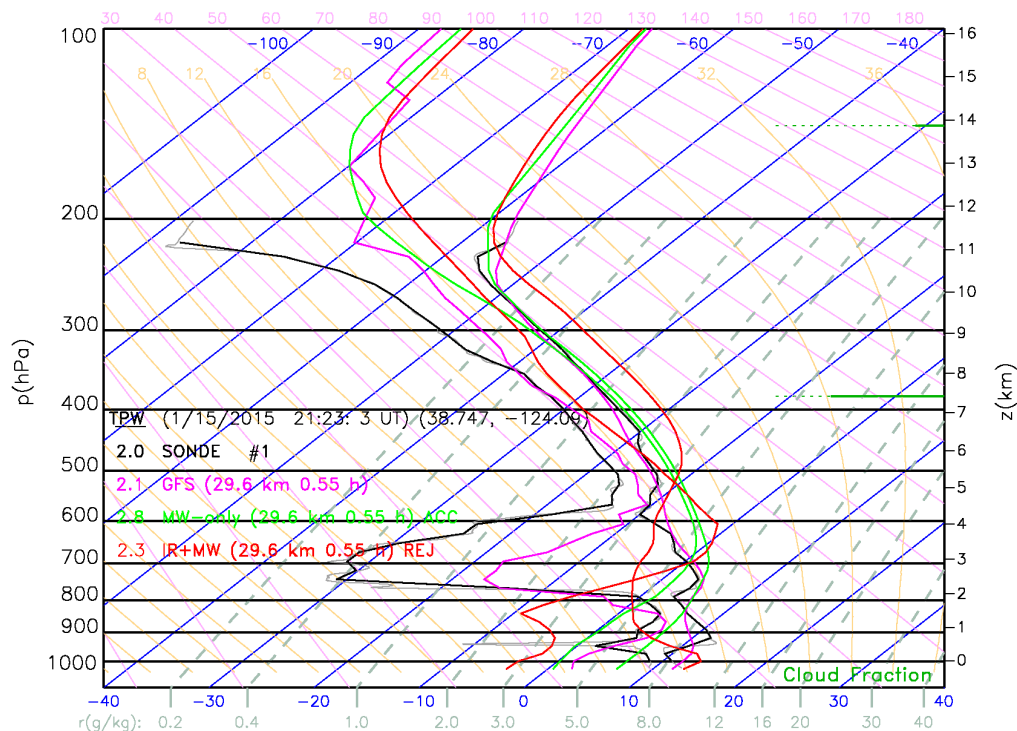
Successfully demonstrated support to a flight campaign with real time NUCAPS retrievals. That is, while flight is in the air we can deliver the 1:30 pm local overpass if the campaign is near a DB site.



Near Real time NUCAPS TPW snapshot using NPP 2200UT overpass, overlapped with the G-IV flight track. Dots indicate drop sonde locations. Point 20: closest NUCAPS-drop sonde match (1.6 minutes apart)



Once dropsondes are received, we can use campaign data for validation



**Sonde, GFS, NUCAPS MW-Only, NUCAPS MW+IR
(GFS interpolated at NUCAPS location)**

- **Rejection occurs primarily in precipitating and overcast scenes**
- **The data are useful for making algorithm improvements**
 - **Identified a few areas of improvements: radiance bias tuning, first guess regression, etc.**
 - **Will test R. Ferraro's precipitation estimate upgrade to NUCAPS (f/ ATMS)**



HWT Support

- **Hazardous Weather Testbed, Experimental Warning Program Relevance of NUCAPS**
 - This product provides forecasters with JPSS observation-based temperature and moisture profiles to aid in severe weather mesoscale analysis.
 - Helps to fill the spatial/temporal gap that exists in observed vertical temperature moisture information.
 - This evaluation seeks to capture the value added by NUCAPS soundings to the severe weather nowcast and warning process.
- **Concept of Operations**
 - NUCAPS is produced at NESDIS/NDE, delivered over the AWIPS Satellite Broadcast Network (SBN) and has been formatted for display in AWIPS-II.
 - Ultimately, NUCAPS soundings would be displayed in NSHARP with Quality Control Flags that provide information from the microwave and IR instruments.
 - Final AWIPS-II display and product integration (with radar/satellite/RAOBs/Surface Observations) will depend on feedback from various

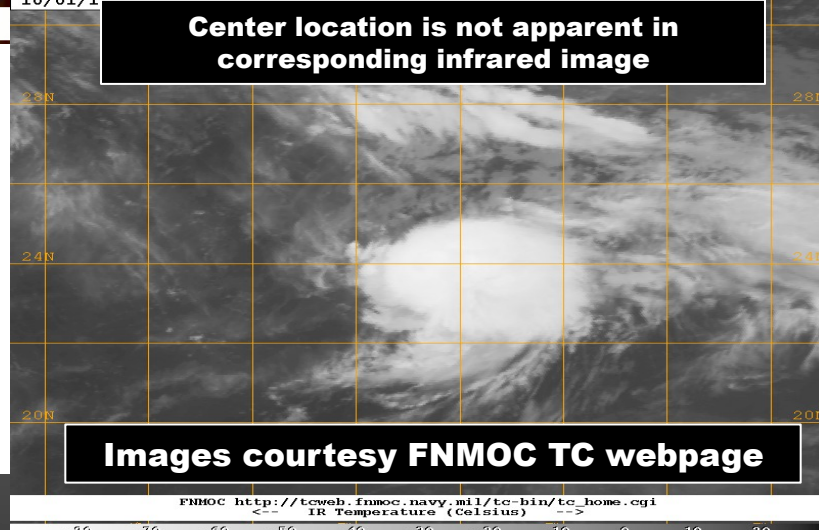
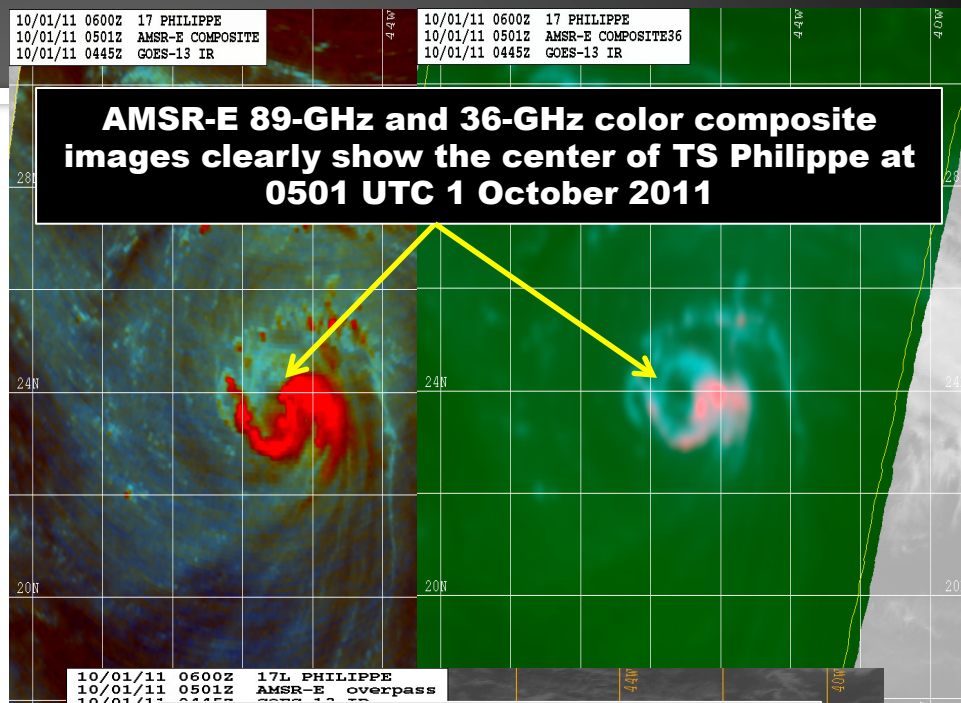


JHT Support



Uses of Microwave Imagery Overview

- Determining if a formative system has a well-defined center, a requirement to initiate advisories
- Locating the center of TCs when the center is not apparent in conventional visible or infrared imagery, especially for weaker systems at night
- Assessing trends in TC structure and intensity, such as eyewall formation and eyewall replacement cycles





Tropical Storm Amanda

23 May 2014

TROPICAL STORM AMANDA DISCUSSION NUMBER 6
NWS NATIONAL HURRICANE CENTER MIAMI FL EP012014
800 PM PDT FRI MAY 23 2014

Amanda has organized quickly over the past few hours. Deep convection now wraps more than halfway around the estimated center position, and **an AMSR-2 microwave pass a few hours ago showed the development of a mid-level eye feature**. Based on the latest ADT estimate from UW-CIMSS the initial intensity has been increased to 50 kt. Now that Amanda is developing inner-core structure, it seems likely that the cyclone will be able to take advantage of the favorable environment and intensify, possibly rapidly, during the next day or so.

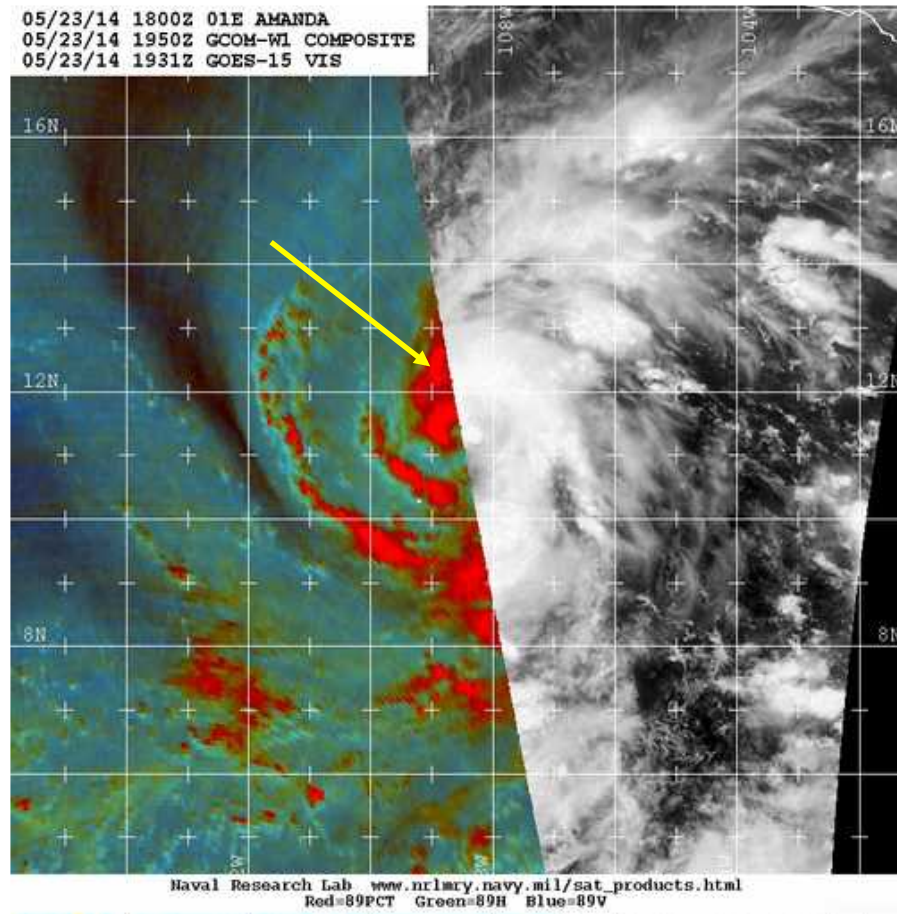


Image courtesy NRL TC webpage



Hurricane Iselle 1 August 2014

HURRICANE ISELLE DISCUSSION NUMBER 6

NWS NATIONAL HURRICANE CENTER MIAMI FL EP092014

800 PM PDT FRI AUG 01 2014

Iselle's cloud pattern has increased in organization since the last advisory, transitioning from a banding to an eye pattern. Cloud top temperatures have also generally cooled in a small central dense overcast that has recently formed. **Though ragged and occasionally obscured by high clouds, the 20 to 25 n mi diameter eye appeared well defined in an earlier AMSR-2 microwave overpass.** Satellite intensity estimates were 3.5 and 4.0 from TAFB and SAB at 0000 UTC, respectively, with the latest ADT CI values at 4.0. Based on these data, the initial intensity is raised to 65 kt.

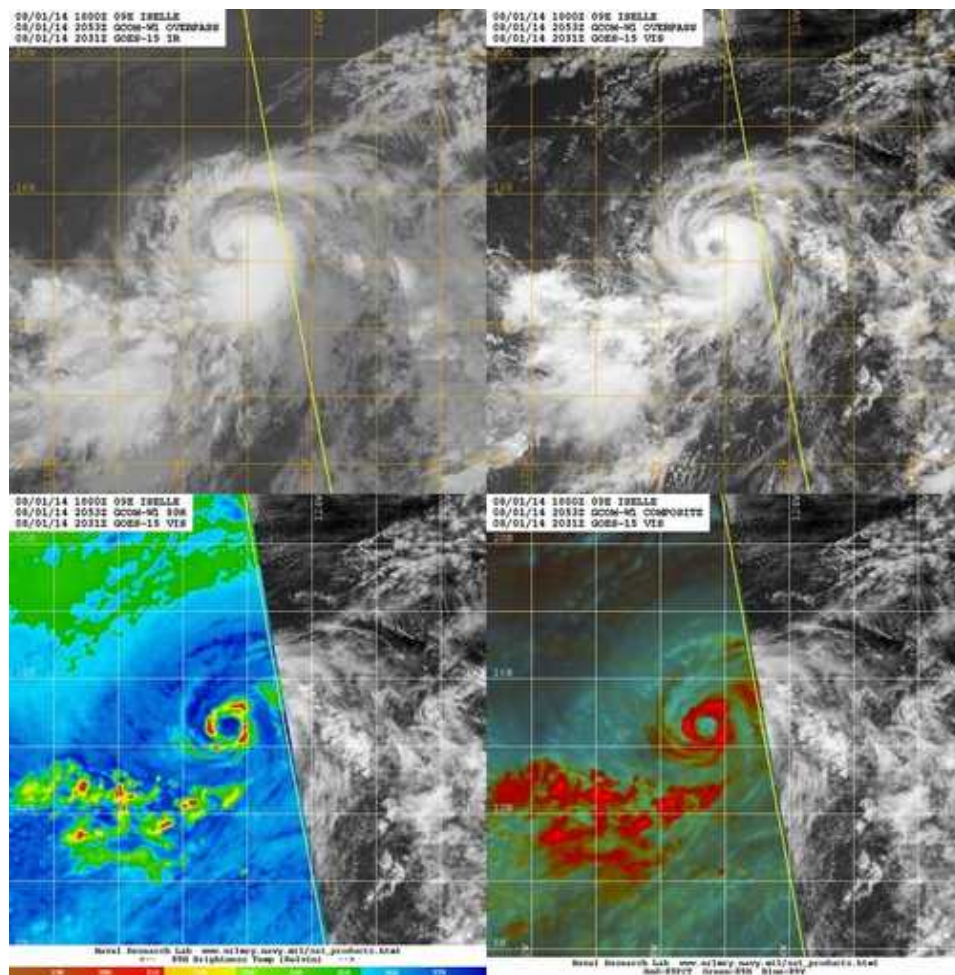


Image courtesy NRL TC webpage



Hurricane Julio

6 August 2014

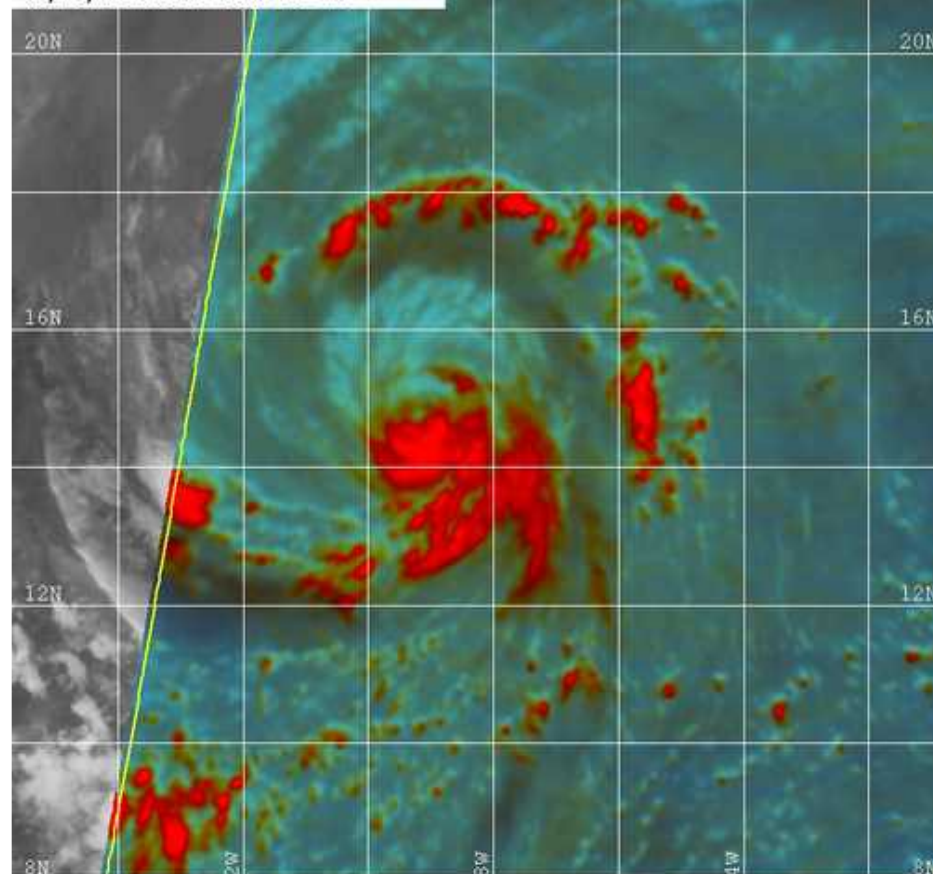
HURRICANE JULIO DISCUSSION NUMBER 11

NWS NATIONAL HURRICANE CENTER MIAMI FL EP102014

800 AM PDT WED AUG 06 2014

Julio has a somewhat ragged appearance in satellite imagery this morning. **While cloud tops near the center are about -80C, AMSR-2 microwave imagery a few hours ago showed that the eyewall was open to the north. That, combined with a large arc cloud seen moving northward away from the center, suggests that dry air entrainment is occurring on the north side.** Satellite intensity estimates are 77 kt from TAFB and 65 kt from SAB. Given the current appearance, the initial intensity remains 65 kt. The cirrus outflow is good over the southwestern semicircle and poor elsewhere.

08/06/14 0600Z 10E JULIO
08/06/14 0938Z GCOM-WI COMPOSITE
08/06/14 0931Z GOES-15 IR



Naval Research Lab www.nrlmry.navy.mil/sat_products.html
Red=89PCT Green=89H Blue=89V

Image courtesy NRL TC webpage



Alaska Aviation Support



Cold Air Aloft

- Kristine Nelson from AK Center Weather Service Unit (AK CWSU) elevated the operational issue in Nov 2014
- The AK CWSU supports Air Traffic Managers at the Anchorage Center through verbal briefings and written warnings.
- Text of current Cold Air Aloft product:

```
FAAK20 KZAN 121458  
ZAN MIS 01 VALID 121500-130300  
...FOR ATC PLANNING PURPOSES ONLY...  
COLD AIR ALOFT  
FROM 185NE SCC-65NE ORT-55SW ENN-110NW BRW-185NE SCC  
TEMPS -65C OR LESS FM FL350-400. AREA MOVG NE 40 KTS.  
CMW NOV 14
```

**Lat/Lon Extent of
Cold Air from
soundings/aircraft
reports/model**

**Vertical Extent of Cold Air
from soundings/aircraft
reports/model**

**Motion
determined
from model data** 28

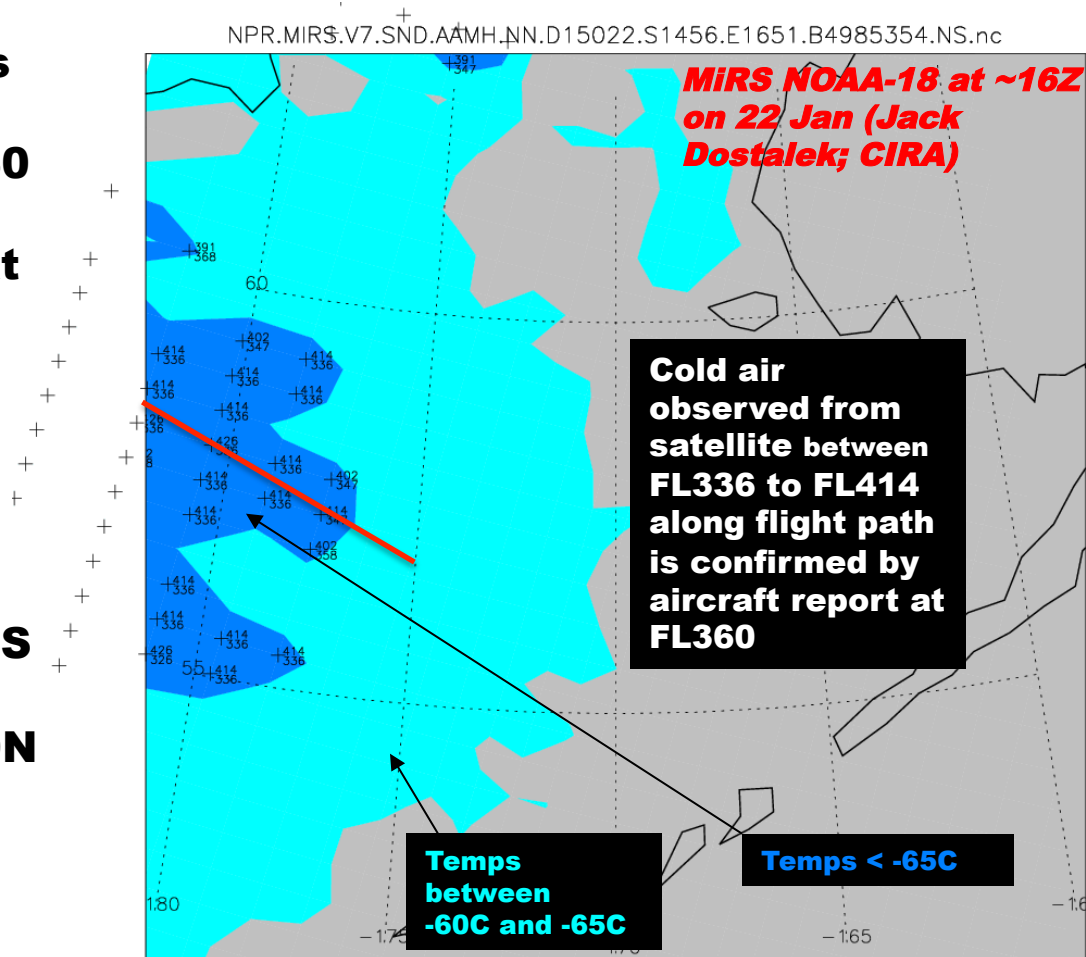
Joint Polar Satellite System



Example Use Case from CIRA/CWSU

- Aircraft reported temperatures at -65C and -66C from lat/lon 54N/175W to 56N/177E at FL360 at 1642z on 22 January
- Most other aircraft are flying at FL330 or lower in that area
- This report was observed by satellite (see right)

**FAAK20 KZAN 221521
ZAN MIS 03 VALID
221530-230330
...FOR ATC PLANNING PURPOSES
ONLY...
FROM 700W HPB-45NW HPB-130N
DUT-525W SYA-700W HPB
COLD AIR ALOFT
TEMPS -65C OR LESS FM FL330-
FL360. STNR. NC.
CMW JAN 15**





JPSS PGRR FY15&16 Call for Proposals

- Call released on 2 Dec 2014 – Focused on 13 Initiatives
- Over 130 Letters of Intent (LOIs) were received
- LOIs evaluated and 90+ asked to consider providing a full proposal
- Full proposals received on 18 Mar
- SME teams established to evaluate Full Proposals



PGRR Call for Proposal Initiatives

- River Ice and Flooding (6)
- Fire and Smoke (5)
- Sounding Applications including NOAA Unique CrIS/ATMS Processing System (NUCAPS) (17)
- NWP impact studies (via HRRR and GFS) and other critical weather applications (13)
- OCONUS and NCEP Service Centers AWIPS Initiative (9)
- Cryosphere Initiative (5)
- Land Data Assimilation (7)
- Ocean and Coastal (12)
- Atmospheric Chemistry (1)
- Hydrology (6)
- Aerosol Data Assimilation (3)
- Innovation (40)
- Training (8)



PGRR Call for Proposal Future Actions

- New Start funding decisions made and communicated to proposal teams
- Determine how new projects will integrate into existing initiatives
- Capture final reports from projects that are ending
- Work with new projects to establish and maintain reporting requirements
- Continue to communicate to user community project successes and milestone progress



Conclusions

An understanding of how JPSS data used throughout NOAA is pivotal to evolving and maintaining a robust satellite mission that serves the needs of all Line Offices.

- SNPP KPPs are now all validated and operational.
- The JPSS Program is on-track for a successful JPSS-1 launch and work continues on JPSS-2
- Since the launch of SNPP, JPSS has actively pursued operational product evaluations through current NOAA Testbed partnerships
- The JPSS PGRR Call-for-Proposals will result in projects funded that can leverage Testbed capabilities
- The JPSS Program is considering future testbed and product testing activities – e.g. STAR algorithm testing
- These actions will ensure the user community is ready to effectively use JPSS-1 and JPSS-2 capabilities to their fullest extent.

